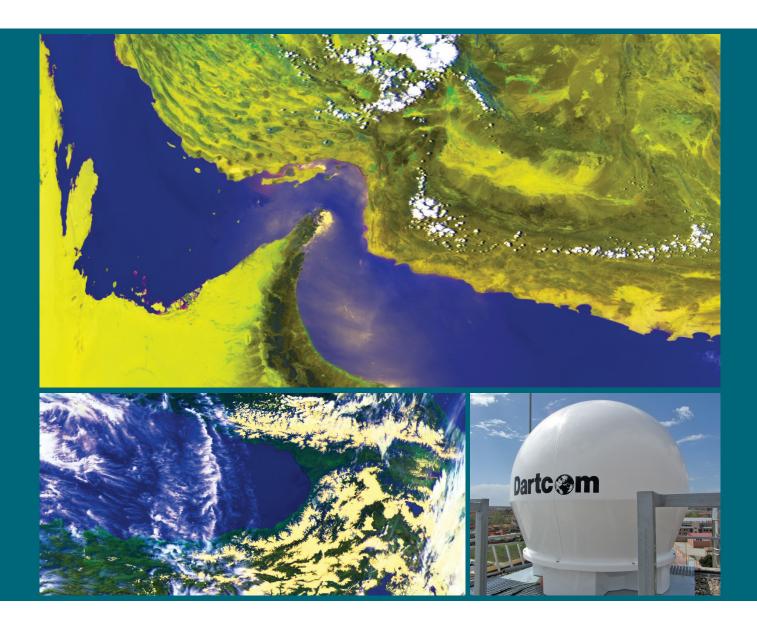# HRPT/AHRPT System

Reliable, high-performance land-based and marine systems for
HRPT, AHRPT and DMSP data from NOAA, Metop, and DMSP-5D satellites

The Dartcom HRPT/AHRPT System receives, archives, processes and displays data from NOAA and Metop (L-Band) polar-orbiting satellites, and optionally DMSP-5D (S-Band) satellites.

Two land-based antennas are available – 1.2m or radome-enclosed 1.5m. For marine use a radome-enclosed 1.5m antenna with active stabilisation can be specified. Both 1.5m antenna options provide a future upgrade path for X-Band EOS reception.

Ingested data can be viewed and processed using the Dartcom iDAP/MacroPro software. Outputs are also available for popular image processing software packages such as PCI Geomatica, ERDAS IMAGINE and ENVI/IDL, as well as standard interchange formats such as NOAA level 1B, EPS level 0 and GeoTIFF.

Direct broadcast GOES HRIT and GEO-KOMPSAT-2A (GK-2A) LRIT reception is also possible, either between polar-orbiter passes or continuously, with optional hardware and software.
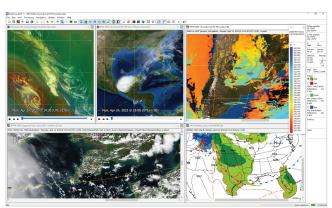
Components

- **Antenna** – land-based and marine options available.
- **Modular receiver rack** containing plug-in modules for easy maintenance and upgrade.
- **Optional temperature sensor unit** for temperature monitoring.
- **Ingest and visualisation PC** running Dartcom Polar Orbiter Ingester and Dartcom iDAP/MacroPro software.

Dartcom can also provide on-site installation and training services.

Features

- Automatic reception, archiving and processing of data from NOAA HRPT and Metop AHRPT polar-orbiting satellites.
- Optional additional modules and Geostationary Ingester software to also allow GOES HRIT or GEO-KOMPSAT-2A (GK-2A) LRIT reception between polar-orbiter passes, or continuously with an optional dedicated antenna.
- Optional feed/LNB and module to allow DMSP reception.
- Optional temperature monitoring with tracking lockout.
- Proven, robust, reliable hardware and software, with installations worldwide in all climates, temperatures and environments.

- Modular construction for easy maintenance and future upgrades.
- Comprehensive hardware and software diagnostics at all levels.

Antenna options

1.2m and radome-enclosed 1.5m antennas are available for fixed, land-based ground stations.

The 1.5m marine antenna uses an active stabilisation system to compensate for the pitch, roll and yaw of a moving vessel at sea.
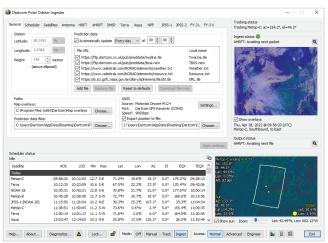
Both 1.5m antenna options provide a future upgrade path for X-Band EOS reception from Terra, Aqua, Suomi-NPP, JPSS, FY-3 and Metop-SG satellites with a Dartcom X-Band EOS System.

Software

- **Polar Orbiter Ingester** – provides automatic satellite tracking, data ingesting, archiving and output.
- **Dartcom iDAP** – provides a wide range of image manipulation and processing facilities such as animation, enhancement, product creation, reprojection, masking, printing and exporting to third-party file formats.
- **Dartcom MacroPro** – automates the image processing facilities provided by iDAP.

Dartcom HRPT/AHRPT System on the British Antarctic Survey research vessel *RRS James Clark Ross,* with a radome-enclosed active-stabilised marine antenna (circled)

Dartcom HRPT/AHRPT System at the Spanish Institute of Oceanography, with a radome-enclosed 1.5m antenna installed on a roof-mounted platform (circled)

Dartcom iDAP/MacroPro software

Dartcom Polar Orbiter Ingester software

Land-based antennas

1.2m and radome-enclosed 1.5m antenna options are available for land-based ground stations. Both provide continuous tracking of satellites with no "cone of silence" (data loss at high elevations).

The Dartcom XPA dual-axis rotator controller with PID function and closed-loop feedback gives excellent pointing accuracy and smooth satellite tracking. A high-speed RS-232/RS-422 serial data link allows the ingest PC to control the rotator and provide status information and diagnostics.

The reflector is a prime focus aluminium parabolic dish finished in matt white paint (RAL 9010). An integrated feed/downconverter (IFD) is mounted at the focal point in a hermetically sealed unit.

The 1.5m antenna allows future system upgrades to receive X-Band EOS data from Terra, Aqua, Suomi-NPP, JPSS and FY-3 satellites.

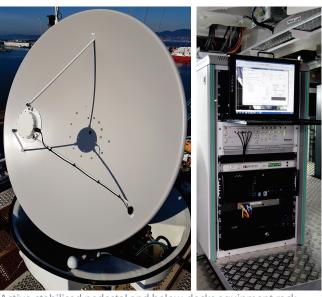### 1.2m parabolic dish and rotator

The 1.2m antenna has a 0.38 F/D ratio and 24.4dBi gain to achieve a system G/T of better than 2.6dBK at 1.7GHz and 5˚ elevation, and a bit error rate of better than 1:10^6 from 3.5˚ elevation.

The dish is mounted on the rotator using a counter-weighted aluminium frame assembly. The rotator is a compact unit with a separate housing for the power supply and controller which is mounted on the pedestal.

The whole dish and rotator assembly is mounted on a galvanised steel pedestal for fixing to a suitable concrete base or steel structure.

1.5m radome-enclosed parabolic dish and rotator

The 1.5m antenna has a 0.36 F/D ratio and 26.0dBi gain to achieve a system G/T of better than 4.3dBK at 1.7GHz and 5˚ elevation, and a bit error rate of better than 1:10^6 from 2˚ elevation.

The dish is mounted on the rotator using a counter-weighted aluminium frame assembly. The rotator is a compact unit with a separate housing for the power supply and controller which is mounted on the pedestal.

The dish and rotator assembly is mounted on a zinc plated, powder coated steel pedestal and enclosed in a two-part (plus base) composite radome with an inspection hatch on the bottom or side. The radome can be fixed to a suitable concrete base or steel structure.

Land-based antenna specifications

	1.2m antenna	**1.5m antenna**
Bit error rate	1:10^6 from 3.5˚ elevation	1:10^6 from 2˚ elevation
Azimuth range	0˚ to 359.9˚ (minimum)	0˚ to 359.9˚ (minimum)
Elevation range	0˚ to 180˚ (minimum)	0˚ to 180˚ (minimum)
Azimuth rate	10˚/second (±10%)	48˚/second (±10%)
Elevation rate	10˚/second (±10%)	10˚/second (±10%)
Mechanical tolerance	±0.15˚ azimuth ±0.15˚ elevation	±0.15˚ azimuth ±0.15˚ elevation
Tracking accuracy	±0.1˚	±0.1˚
Temperature	−20˚C to +60˚C operational	−20˚C to +60˚C operational (−40˚C with optional heater)
Wind speeds	85km/h (46kt) operational 145km/h (78kt) survival	185km/h (100kt) operational 240km/h (130kt) survival

Dartcom 1.2m land-based antenna

Integrated feed/downconverter specifications

Feed:	
Beamwidth	3dB at 80˚ 10dB at 150˚
Gain	+4.5dBi
Polarisation	Right-hand circular
Input filter:	
Insertion loss	0.3dB maximum
Bandwidth	120MHz maximum
Overall:	
Noise figure	1.2dB typical
Gain	60dB minimum
Converted bandwidth	50MHz typical
Input range	1682–1710MHz
IF output	117–145MHz

Dartcom radome-enclosed 1.5m land-based antenna

1.5m active-stabilised marine antenna

This antenna tracks polar-orbiting satellites on moving vessels using a state-of-the-art active-stabilised X-Y pedestal to compensate for pitch, roll and yaw. It is CE certified and has been designed to meet or exceed military standard (MIL-STD) specifications.

It has continuous axis movement to eliminate cable wrap problems without slip-rings or rotary joints. Together with the pedestal's high speed and accuracy this ensures no "cone of silence" (data loss at high elevations).

An F/D ratio of 0.35 and 26dBiC gain (S-band 28dBiC) achieve a system G/T of >4.3dBK at 1.7GHz and >6.7dB/K at 2.252GHz, both at 5˚ elevation, and a bit error rate of <1:10^6 from 2˚ elevation.

The reflector is a 1.5m diameter prime focus aluminium parabolic dish finished in light grey paint. An integrated feed/downconverter (IFD) is mounted at the focal point in a hermetically sealed unit – see the *Land-based antennas* section for specifications.

The dish, pedestal assembly and antenna control unit (ACU) are mounted inside a weather-tight composite radome with a hatch in the base or side. The ACU provides fully automatic control of the pedestal with an advanced stabilisation algorithm. Full diagnostics and maintenance facilities are available via the ingest PC which is housed in a below-decks equipment rack.

This antenna allows future system upgrades to receive X-Band EOS data from Terra, Aqua, Suomi-NPP, JPSS and FY-3 satellites.

1.5m active-stabilised marine antenna specifications

Pedestal:	
Stabilisation	Active, with gyro sensors for pitch, roll and yaw rates
Azimuth range	No limit (continuous)
Elevation range	−10˚ to 190˚
Pitch rate	±15˚ in 8 seconds
Roll rate	±30˚ in 8 seconds
Yaw rate	±80˚ in 50 seconds
Turn rate	10˚/second
Total weight	180kg approx
Radome:	
Height	1.98m approx
Diameter	1.96m approx
Environment:	
Wind speed	185km/h (100kt) operational 240km/h (130kt) survival
Temperature	−10˚C to +70˚C operational (−40˚C with optional heater)
Design specifications:	
EMI/RFI	MIL-STD-461
Vibration	MIL-STD-167-1
Shock	MIL-STD-901
Power requirements:	
Voltage	115/230V AC @ 50/60Hz
Power consumption	1000VA typical

Dartcom 1.5m active-stabilised marine antenna (circled) installed on the oceanographic research vessel *BAP Carrasco*

Active-stabilised pedestal and below-decks equipment rack

Receiver rack

The receiver rack is supplied as standard with a single LRD-100 digital multi-mode receiver and HRPT and AHRPT USB interfaces for reception of NOAA HRPT and Metop AHRPT data.

If GOES HRIT or GK-2A LRIT reception is required, a second LRD-100 receiver and an LRIT USB interface can be fitted.

Alternatively an LRD-200B receiver can be supplied instead of the LRD-100 to provide HRPT and AHRPT reception, plus GOES HRIT or GK-2A LRIT reception between polar-orbiter passes, all with one receiver.
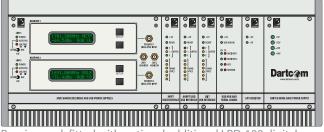
If DMSP reception is required, a DMSP USB interface can be fitted. However GOES HRIT and GK-2A LRIT reception is then not possible unless a separate Dartcom USB LRIT receiver is supplied.
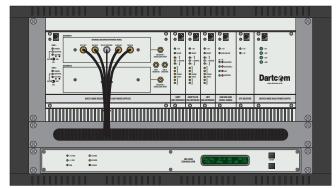
Features

- 19" 4U high Eurocard rack.
- Plug-in modules for easy maintenance and upgrades.
- Desk or rack mount.
- USB connection for data, rack control and GPS receiver.
- RS-232/422/485 connection for rotator control, or optionally via USB if serial ports are not available on the ingest PC.

Modules

- Multi-mode receivers and LNB power supplies module containing up to two digital multi-mode receivers (one as standard).
- HRPT USB interface.
- AHRPT USB interface.
- Optional DMSP or LRIT USB interface.
- USB hub and serial communications module containing 7-port USB hub, USB serial adaptors and RS-232/422/485 rotator interface.
- GPS receiver.
- Switch mode rack power supply.

Receiver rack fitted with optional additional LRD-100 digital multi-mode receiver and LRIT USB interface module

Receiver rack with optional LRD-200B digital multi-mode receiver and LRIT USB interface module
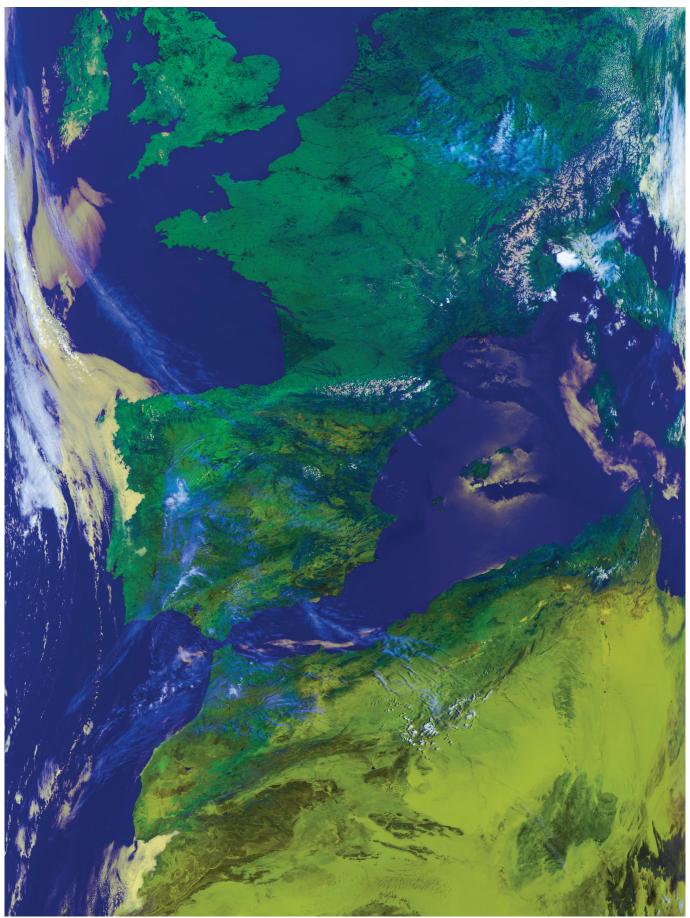
Receiver rack specifications

Operating temperature	0˚C to +50˚C
Storage temperature	0˚C to +70˚C
Humidity	30% to 70% non-condensing
EMC emissions	EN61000-6-4:2007 A1
EMC immunity	EN61000-6-2:2005
Electrical safety	LVD 2006/95/EC
	EN60950-1:2006
Dimensions (W×H×D)	450×180×455mm including connector projections
Weight	14.5kg approx
Power requirements	110–240V AC @ 50–400Hz
Power consumption	150VA
Wild heat	100W

Digital multi-mode receiver specifications

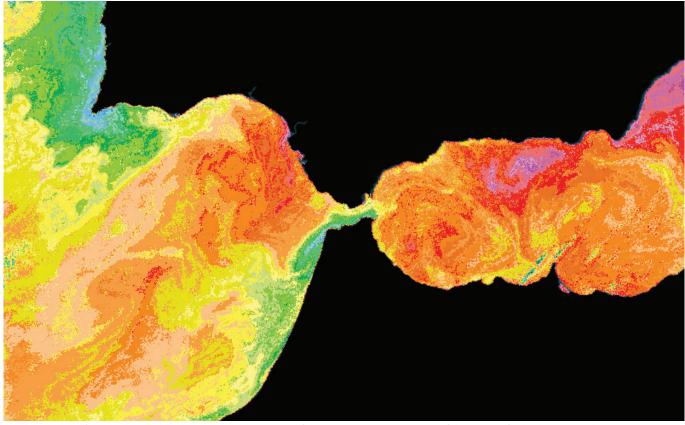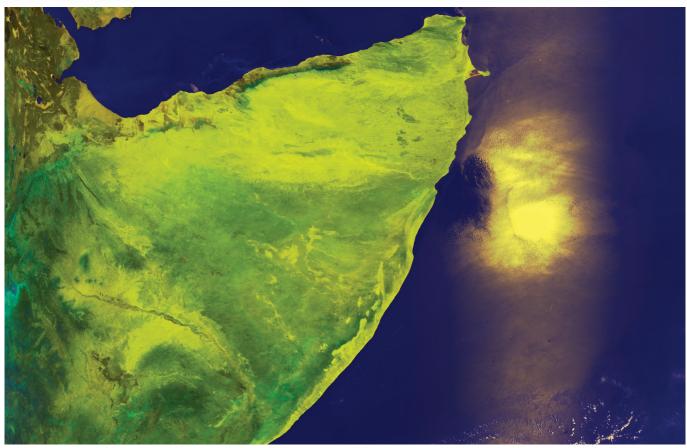|	**LRD-100**	**LRD-200B**
Signal input range	−90dBm to −20dBm	−90dBm to −20dBm
IF conversion	Direct 70MHz, up to 50Msps, 10-bit resolution	Direct 70MHz, up to 50Msps, 10-bit resolution
IF bandwidth	Programmable	Programmable
Supported symbol rates	0.1–3.5Msps	0.1–3.5Msps
Demodulator modes	BPSK, QPSK, PSK	BPSK, QPSK, PSK, 8PSK, 16QAM
BPSK/QPSK performance	BPSK/QPSK within 1dB of theoretical, 0.5dB typical	BPSK/QPSK within 0.4dB of theoretical, 0.2dB typical
Convolution decoding	Viterbi, rate ¾	Viterbi, rates ½ and ¾
RF inputs	Simulator or signal, selectable	Simulator or signal, selectable
Outputs	50Ω TTL clock and NRZ data	50Ω TTL clock and NRZ data
Display	LCD, 16-character × 2 line	LCD, 16-character × 2 line
Control interface	RS-232 serial via USB serial adaptor	RS-232 serial via USB serial adaptor

Metop-A AVHRR false colour composite image (channels 1, 2 and 4) showing Europe and northern Africa
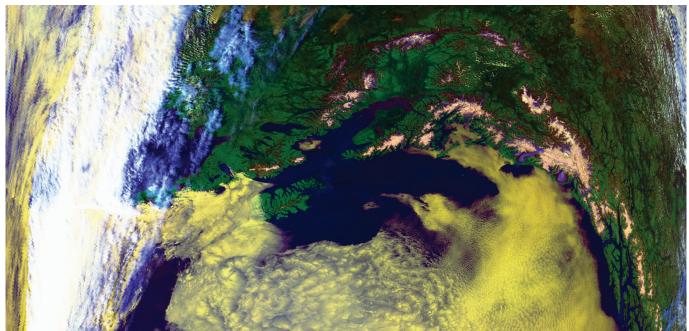
Normalised Difference Vegetation Index (NDVI) product created from a NOAA AVHRR image of Spain and Portugal using the Projection Transformation, Formula Palette and DEM Masking functions of the Dartcom iDAP software

McClain Sea Surface Temperature (MCSST) product created from a NOAA AVHRR image of the Strait of Gibraltar using the Projection Transformation, Formula Palette and DEM Masking functions of the Dartcom iDAP software

NOAA AVHRR HRPT false colour composite image showing the Horn of Africa with sun glint on a dust plume

NOAA AVHRR HRPT false colour composite image of Alaska showing low cloud in yellow and snow on the mountain tops